

Records of drilling used to construct the illustration titled
Cross section showing subsurface geology below
the proposed Hyperion Energy Center

Location Information

Legal Location:SE SE SE SE SEC. 36, T. 093 N., R. 51 W.

County:CLAY

Basin:BIG SIOUX

Hydrologic Unit Code:10170203

Land Owner:

Location:093N-51W-36DDDD

Latitude:42 49' 22"

Longitude: 96 48' 23"

Ground Surface Elevation (ft.):1235 T

Project Information

Project:LINCOLN-UNION CO. STUDY

Drill Date:10/31/1985

Company:SDGS

Drilling Method:ROTARY

Test Hole Number:R2-85-128

Samples:

Geologist:R. HAMMOND

Geologist's Log:X

Driller:R. GRAVHOLT

Driller's Log:

Total Drill Hole Depth (ft.):255.0

Geophysical Information

Spontaneous Potential:X

Natural Gamma:X

Single Point Resistivity:X

Extra:

TEST HOLE PLUGGED FROM 255 TO 8 FEET WITH VOL PLUG (GREATER THAN 100 SECONDS MARSH FUNNEL VELOCITY), 8 FEET TO 3 FEET WITH NEAT CEMENT, AND 3 TO 0 FEET WITH TOPSOIL. A PLASTIC PLUG WAS SET AT 8 FEET.

<u>Elevation (ft.)</u>	<u>Depth (ft.)</u>	<u>Description</u>
1235.00 - 1218.00	0.0 - 17.0	CLAY, LIGHT-BROWN, SILTY, SANDY, PEBBLY (TILL)
1218.00 - 1115.00	17.0 - 120.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
1115.00 - 1104.00	120.0 - 131.0	SAND, DARK-GRAY, MEDIUM TO FINE, VERY SILTY
1104.00 - 1086.00	131.0 - 149.0	SAND, MEDIUM, WELL-SORTED, SUBROUNDED; LARGELY QUARTZ
1086.00 - 1059.00	149.0 - 176.0	GRAVEL, BROWN, MEDIUM TO FINE, SANDY
1059.00 - 1041.00	176.0 - 194.0	SAND, GREEN, MEDIUM TO COARSE, PEBBLY; SOME SHALE, COAL, AND CARBONATE CLASTS (WESTERN SANDS)
1041.00 - 1033.00	194.0 - 202.0	SILT, TAN TO LIGHT-GRAY, SANDY (LOESS)
1033.00 - 1013.00	202.0 - 222.0	CLAY, GRAY-BROWN, SANDY, SLIGHTLY PEBBLY (TILL)
1013.00 - 1004.00	222.0 - 231.0	GRAVEL, GREEN, MEDIUM, SANDY, SUBROUNDED TO SUBANGULAR, FAIR SORTING (WESTERN SANDS)
1004.00 - 980.00	231.0 - 255.0	SILTSTONE, LIGHT-GRAY-BROWN, VERY SANDY; CONTAINS THIN GRAY SHALE LAYERS (DAKOTA FORMATION)

Location Information

Legal Location:SW SW NW NW SEC. 04, T. 092 N., R. 50 W.
County:UNION Location:092N-50W-04BBCC 1
Basin:BIG SIOUX Latitude:42 49' 03"
Hydrologic Unit Code:10170203 Longitude: 96 46' 01"
Land Owner: Ground Surface Elevation (ft.):1236 T

Project Information

Project:STATEWIDE MONITORING Geologist:M. NOONAN
Drill Date:07/30/2008 Geologist's Log:X
Company:SDGS Driller:S. JENSEN
Drilling Method:ROTARY Driller's Log:
Test Hole Number:R2-2008-17 Total Drill Hole Depth (ft.):245.0
Samples:

Geophysical Information

Spontaneous Potential:X Single Point Resistivity:X
Natural Gamma:X Extra:

TEST HOLE PLUGGED WITH BENTONITE GROUT FROM 245 FEET TO 5 FEET BELOW LAND SURFACE,
CEMENT GROUT FROM 5 FEET BELOW LAND SURFACE TO LAND SURFACE.

<u>Elevation (ft.)</u>	<u>Depth (ft.)</u>	<u>Description</u>
1236.00 - 1234.00	0.0 - 2.0	ROADFILL
1234.00 - 1226.00	2.0 - 10.0	CLAY, RED-BROWN, SILTY, SANDY, PEBBLY
1226.00 - 1205.00	10.0 - 31.0	CLAY, TAN, SILTY, SANDY, PEBBLY, CHALKY (TILL)
1205.00 - 1141.00	31.0 - 95.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
1141.00 - 1131.00	95.0 - 105.0	GRAVEL, FINE; INTERBEDDED LAYERS OF FINE TO COARSE SAND
1131.00 - 1119.00	105.0 - 117.0	CLAY, GRAY, SILTY, SANDY, PEBBLY (TILL)
1119.00 - 1056.00	117.0 - 180.0	SAND AND GRAVEL, FINE SAND TO FINE PEBBLE GRAVEL
1056.00 - 991.00	180.0 - 245.0	GRAVEL, FINE TO COARSE; INTERBEDDED LAYERS OF FINE TO COARSE SAND

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Location Information

Legal Location:NW NE NE NE SEC. 04, T. 092 N., R. 50 W.

County:UNION

Location:092N-50W-04AAAB

Basin:BIG SIOUX

Latitude:42 49' 21"

Hydrologic Unit Code:10170203

Longitude: 96 45' 05"

Land Owner:

Ground Surface Elevation (ft.):1230 T

Project Information

Project:LINCOLN-UNION CO. STUDY

Geologist:R. HAMMOND

Drill Date:11/05/1984

Geologist's Log:X

Company:SDGS

Driller:T. MCCUE

Drilling Method:ROTARY

Driller's Log:

Test Hole Number:R1-84-103

Total Drill Hole Depth (ft.):365.0

Samples:

Geophysical Information

Spontaneous Potential:X

Single Point Resistivity:X

Natural Gamma:X

Extra:

<u>Elevation (ft.)</u>	<u>Depth (ft.)</u>	<u>Description</u>
1230.00 - 1227.00	0.0 - 3.0	TOPSOIL, BLACK
1227.00 - 1212.00	3.0 - 18.0	CLAY, YELLOW, VERY PEBBLY, SANDY (TILL)
1212.00 - 1192.00	18.0 - 38.0	CLAY, GRAY, VERY PEBBLY, SANDY (TILL)
1192.00 - 1161.00	38.0 - 69.0	GRAVEL, LIGHT-GRAY, VERY SANDY, CHALKEY, CLAYEY, ANGULAR
1161.00 - 1118.00	69.0 - 112.0	CLAY, LIGHT-GRAY, SILTY, PEBBLY (TILL)
1118.00 - 978.00	112.0 - 252.0	GRAVEL, FINE, VERY SANDY; MINOR SOFT ROCK FRACTION, SUBROUNDED
978.00 - 920.00	252.0 - 310.0	SANDSTONE, LIGHT-GRAY AND GRAY-BROWN, VERY SILTY; SOME THIN GRAY TO BLACK SHALE BEDS (DAKOTA FORMATION)
920.00 - 865.00	310.0 - 365.0	SANDSTONE, WHITE TO LIGHT-GRAY, FINE TO VERY FINE; ABUNDANT LIGHT-TAN AND LIGHT-GRAY SHALE LENSES AT 325 TO 359 FEET (DAKOTA FORMATION)

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Location Information

Legal Location:SE SW SW SW SEC. 36, T. 093 N., R. 50 W.

County:UNION

Location:093N-50W-36CCCD

Basin:BIG SIOUX

Latitude:42 49' 23"

Hydrologic Unit Code:10170203

Longitude: 96 42' 27"

Land Owner:

Ground Surface Elevation (ft.):1180 T

Project Information

Project:LINCOLN-UNION CO. STUDY

Geologist:M. JARRETT

Drill Date:07/02/1986

Geologist's Log:X

Company:SDGS

Driller:J. FRAZIER

Drilling Method:AUGER

Driller's Log:

Test Hole Number:A2-86-176

Total Drill Hole Depth (ft.):28.0

Samples:

Geophysical Information

Spontaneous Potential:

Single Point Resistivity:

Natural Gamma:

Extra:

<u>Elevation (ft.)</u>	<u>Depth (ft.)</u>	<u>Description</u>
1180.00 - 1178.00	0.0 - 2.0	TOPSOIL
1178.00 - 1161.00	2.0 - 19.0	CLAY, BROWN, SILTY, SANDY; OXIDIZED (TILL)
1161.00 - 1156.00	19.0 - 24.0	CLAY, TAN, SILTY, SANDY; OXIDIZED (TILL)
1156.00 - 1152.00	24.0 - 28.0	CLAY, GRAY, SILTY, SANDY; UNOXIDIZED (TILL)

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Location Information

Legal Location: NW NW NW NW SEC. 06, T. 092 N., R. 49 W.

County: UNION

Location: 092N-49W-06BBBB

Basin: BIG SIOUX

Latitude: 42 49' 19"

Hydrologic Unit Code: 10170203

Longitude: 96 41' 14"

Land Owner:

Ground Surface Elevation (ft.): 1290 T

Project Information

Project: LINCOLN-UNION CO. STUDY

Geologist: R. HAMMOND

Drill Date: 11/05/1985

Geologist's Log: X

Company: SDGS

Driller: C. SCHMIG

Drilling Method: ROTARY

Driller's Log:

Test Hole Number: R2-85-134

Total Drill Hole Depth (ft.): 180.0

Samples:

Geophysical Information

Spontaneous Potential: X

Single Point Resistivity: X

Natural Gamma: X

Extra:

THIS HOLE WAS PLUGGED BY PRESSURE GROUTING FROM BOTTOM TO 8 FEET WITH BENTONITE SLURRY (GREATER THAN 100 SECOND MARSH FUNNEL VISCOSITY), A PLUG WAS SET AT 8 FEET, NEAT CEMENT POURED FROM 8 FEET TO 3 FEET AND BACKFILLED TO SURFACE WITH TOPSOIL.

<u>Elevation (ft.)</u>	<u>Depth (ft.)</u>	<u>Description</u>
1290.00 - 1268.00	0.0 - 22.0	CLAY, YELLOW, VERY SILTY; NUMEROUS RED- BROWN ROOT CASTS (LOESS)
1268.00 - 1234.00	22.0 - 56.0	SILT, REDDISH-BROWN, MOTTLED WITH GRAY FROM 35 TO 56 FEET, SANDY, CLAYEY (LOESS)
1234.00 - 1217.00	56.0 - 73.0	CLAY, ORANGE TO DARK-GRAY; GREASY, SOFT (CARLILE SHALE)
1217.00 - 1180.00	73.0 - 110.0	CLAY, DARK-GRAY-BROWN; FAIR SHALEY PARTING, HARD, SLIGHTLY CALCAREOUS, WHITE BENTONITE AT 81 TO 82 FEET, HIGH GAMMA VALUES AT 73 TO 98 FEET (FAIRPORT SHALE MEMBER - CARLILE SHALE)
1180.00 - 1171.00	110.0 - 119.0	SILTSTONE, DARK-GRAY-BROWN, CLAYEY; SOFT, CALCAREOUS, FAIR SHALEY PARTINGS (FAIRPORT SHALE MEMBER - CARLILE SHALE)
1171.00 - 1120.00	119.0 - 170.0	CLAYSTONE, DARK-GRAY, SLIGHTLY SILTY; SLIGHTLY CALCAREOUS, FAIR TO GOOD SHALEY PARTINGS (FAIRPORT SHALE MEMBER - CARLILE SHALE)
1120.00 - 1110.00	170.0 - 180.0	SILTSTONE, GRAY-BROWN; VERY CALCAREOUS, MANY LAYERS CONSIST OF PRIMARILY INOCERAMUS SHELL DEBRIS; ROUGH IRREGULAR DRILLING CHARACTER (GREENHORN LIMESTONE)

Location Information

Legal Location:NW NE NE NW SEC. 04, T. 092 N., R. 49 W.

County:UNION

Location:092N-49W-04BAAB

Basin:BIG SIOUX

Latitude:42 49' 20"

Hydrologic Unit Code:10170203

Longitude: 96 38' 17"

Land Owner:

Ground Surface Elevation (ft.):1205 T

Project Information

Project:LINCOLN-UNION CO. STUDY

Geologist:M. JARRETT

Drill Date:07/08/1986

Geologist's Log:X

Company:SDGS

Driller:K. WUNDER

Drilling Method:AUGER

Driller's Log:

Test Hole Number:A1-86-141

Total Drill Hole Depth (ft.):28.0

Samples:

Geophysical Information

Spontaneous Potential:

Single Point Resistivity:

Natural Gamma:

Extra:

<u>Elevation (ft.)</u>	<u>Depth (ft.)</u>	<u>Description</u>
1205.00 - 1189.00	0.0 - 16.0	CLAY, BLACK, SILTY; OXIDIZED, MOIST
1189.00 - 1184.00	16.0 - 21.0	CLAY, BLACKISH-BROWN, SILTY, SLIGHTLY SANDY; OXIDIZED, SATURATED
1184.00 - 1177.00	21.0 - 28.0	CLAY, BLACKISH-BROWN, SILTY, SLIGHTLY SANDY; OXIDIZED, SATURATED

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Location Information

Legal Location:SW SW NW NW SEC. 03, T. 092 N., R. 49 W.

County:UNION

Location:092N-49W-03BBCC

Basin:BIG SIOUX

Latitude:42 49' 08"

Hydrologic Unit Code:10170203

Longitude: 96 37' 31"

Land Owner:

Ground Surface Elevation (ft.):1285 T

Project Information

Project:LINCOLN-UNION CO. STUDY

Geologist:R. HAMMOND

Drill Date:11/05/1985

Geologist's Log:X

Company:SDGS

Driller:R. GRAVHOLT

Drilling Method:ROTARY

Driller's Log:

Test Hole Number:R2-85-133

Total Drill Hole Depth (ft.):280.0

Samples:

Well Information

SDGS Well Name: R2-85-133

Aquifer:DAKOTA

Water Rights Well:

Management Unit:

Other Well Name:

Casing Top Elevation:1288.00 T

Casing Type:PVC

Casing Diameter (in.):2.0

Screen Type:PVC, MFG.

Screen Length (ft.):10.0

Total Casing and Screen (ft.):270.0

Casing Stick-up (ft.):

Well Maintenance Date:

Geophysical Information

Spontaneous Potential:X

Single Point Resistivity:X

Natural Gamma:X

Extra:

THIS WELL WAS GRAVEL PACKED FROM 280 TO 200 FEET, PRESSURE GROUTED FROM 200 TO 20 FEET WITH BENTONITE SLURRY (GREATER THAN 100 SECONDS MARSH VELOCITY), THEN FILLED WITH NEAT CEMENT GROUT FROM 20 FEET TO GROUND LEVEL.

<u>Elevation (ft.)</u>	<u>Depth (ft.)</u>	<u>Description</u>
1285.00 - 1251.00	0.0 - 34.0	CLAY, YELLOW, VERY SILTY, SANDY (LOESS)
1251.00 - 1198.00	34.0 - 87.0	SILT, REDDISH-BROWN, SANDY, CLAYEY, VERY SANDY AT 45 TO 87 FEET (LOESS)
1198.00 - 1139.00	87.0 - 146.0	CLAY, DARK-GRAY-BROWN; FAIR TO POORLY FISSILE, HARD, SLIGHTLY CALCAREOUS (FAIRPORT SHALE MEMBER - CARLILE SHALE)
1139.00 - 1111.00	146.0 - 174.0	SILTSTONE, DARK-GRAY-BROWN; VERY CALCAREOUS; CONTAINS ABUNDANT SHELL DEBRIS (GREENHORN LIMESTONE)
1111.00 - 1065.00	174.0 - 220.0	CLAY, GRAY-BROWN; HARD, SLIGHTLY CALCAREOUS (GRANEROS SHALE)

1065.00 - 1025.00	220.0 - 260.0	SILTSTONE, GRAY; WITH THIN SHALE AND SANDSTONE LENSES (DAKOTA FORMATION)
1025.00 - 1015.00	260.0 - 270.0	SANDSTONE, LIGHT-GRAY, VERY FINE; POORLY CEMENTED (DAKOTA FORMATION)
1015.00 - 1006.00	270.0 - 279.0	SANDSTONE(?), GRAY, VERY SHALEY (DAKOTA FORMATION)
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Location Information

Legal Location:NE NW NW NW SEC. 02, T. 092 N., R. 49 W.

County:UNION

Location:092N-49W-02BBBA

Basin:BIG SIOUX

Latitude:42 49' 20"

Hydrologic Unit Code:10170203

Longitude: 96 36' 17"

Land Owner:

Ground Surface Elevation (ft.):1128 T

Project Information

Project:BIG SIOUX HYDRO STUDY

Geologist:W. BRADFORD

Drill Date:06/19/1985

Geologist's Log:

Company:SDGS

Driller:D. IVERSON

Drilling Method:HOLLOWSTEM

Driller's Log:X

Test Hole Number:R20-85-104

Total Drill Hole Depth (ft.):25.0

Samples:

Geophysical Information

Spontaneous Potential:

Single Point Resistivity:

Natural Gamma:

Extra:

<u>Elevation (ft.)</u>	<u>Depth (ft.)</u>	<u>Description</u>
1128.00 - 1126.00	0.0 - 2.0	TOPSOIL, BLACK
1126.00 - 1106.00	2.0 - 22.0	CLAY, YELLOWISH-BROWN
1106.00 - 1103.00	22.0 - 25.0	CLAY, GRAY

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Location Information

Legal Location:NW NW NE NE SEC. 02, T. 092 N., R. 49 W.

County:UNION

Location:092N-49W-02AABB

Basin:BIG SIOUX

Latitude:42 49' 20"

Hydrologic Unit Code:10170203

Longitude: 96 35' 28"

Land Owner:

Ground Surface Elevation (ft.):1131 T

Project Information

Project:LINCOLN-UNION CO. STUDY

Geologist:M. JARRETT

Drill Date:07/01/1986

Geologist's Log:X

Company:SDGS

Driller:J. FRAZIER

Drilling Method:AUGER

Driller's Log:

Test Hole Number:A2-86-164

Total Drill Hole Depth (ft.):28.0

Samples:

Geophysical Information

Spontaneous Potential:

Single Point Resistivity:

Natural Gamma:

Extra:

<u>Elevation (ft.)</u>	<u>Depth (ft.)</u>	<u>Description</u>
1131.00 - 1124.00	0.0 - 7.0	ROADFILL
1124.00 - 1110.00	7.0 - 21.0	CLAY, BROWN, SILTY, SANDY, PEBBLY; OXIDIZED (TILL)
1110.00 - 1105.00	21.0 - 26.0	CLAY, BROWN, VERY SILTY, SANDY; OXIDIZED (TILL)
1105.00 - 1098.00	26.0 - 33.0	CLAY, BROWN, SILTY, VERY SANDY, PEBBLY; OXIDIZED (TILL)
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Location Information

Legal Location:SE NW SW SE SEC. 36, T. 093 N., R. 49 W.

County:PLYMOUTH, IA

Location:093N-49W-36DCBD

Basin:BIG SIOUX

Latitude:42 49' 30"

Hydrologic Unit Code:10170203

Longitude: 96 34' 29"

Land Owner:

Ground Surface Elevation (ft.):1135 T

Project Information

Project:BIG SIOUX HYDRO STUDY

Geologist:W. BRADFORD

Drill Date:06/10/1985

Geologist's Log:

Company:SDGS

Driller:D. IVERSON

Drilling Method:HOLLOWSTEM

Driller's Log:X

Test Hole Number:R20-85-57

Total Drill Hole Depth (ft.):30.0

Samples:

Geophysical Information

Spontaneous Potential:

Single Point Resistivity:

Natural Gamma:

Extra:

<u>Elevation (ft.)</u>	<u>Depth (ft.)</u>	<u>Description</u>
1135.00 - 1133.00	0.0 - 2.0	TOPSOIL, BLACK
1133.00 - 1120.00	2.0 - 15.0	CLAY, YELLOWISH-BROWN (TILL)
1120.00 - 1115.00	15.0 - 20.0	SAND, MEDIUM
1115.00 - 1105.00	20.0 - 30.0	CLAY, GRAY

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